SECTION 8.15

Paleontological Resources

8.15 Paleontological Resources

8.15.1 Introduction

Paleontological resources (fossils) are the remains or traces of prehistoric plants and animals. Fossils are important scientific and educational resources because of their use in: (1) documenting the presence and evolutionary history of particular groups of now extinct organisms, (2) reconstructing the environments in which these organisms lived, and (3) determining the relative ages of the strata in which they occur and the geologic events that resulted in the deposition of the sediments that formed these strata. This section of the Small Power Plant Exemption (SPPE) Application summarizes the potential environmental impacts on paleontological resources that may result from construction of the Modesto Irrigation District (MID) Electric Generation Station (MEGS) Project (Project).

8.15.2 Laws, Ordinances, Regulations, and Standards

Paleontological resources are non-renewable scientific resources and are protected by several federal and state statutes (California Office of Historic Preservation, 1983; see also Marshall, 1976; West, 1991; Fisk and Spencer, 1994), most notably by the 1906 Federal Antiquities Act and other subsequent federal legislation and policies and by State of California's environmental regulations (CEQA, Section 15064.5). Professional standards for assessment and mitigation of adverse impacts on paleontological resources have been established by the Society of Vertebrate Paleontology (SVP, 1991, 1995, 1996). Design, construction, and operation of the proposed MEGS, including a subtransmission line, water and natural gas supply pipelines, and other ancillary facilities, will be conducted in accordance with all laws, ordinances, regulations, and standards (LORS) applicable to paleontological resources. Federal and state LORS applicable to paleontological resources are summarized in Table 8.15-1 and discussed briefly below, along with SVP professional standards.

8.15.2.1 Federal LORS

Federal protection for significant paleontological resources would only apply to the MEGS Project if any construction or other related Project impacts occur on federally owned or federally managed lands. Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (PL 59-209; 16 United States Code 431 *et seq.*; 34 Stat. 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal lands.

TABLE 8.15-1
LORS Applicable to Paleontological Resources

LORS	Applicability	Reference	Project Conformity
Antiquities Act of 1906	Protects paleontological resources on federal lands	Section 8.15.2	Yes
CEQA, Appendix G	Fossil remains may be encountered by earth-moving	Section 8.15.2.2	Yes
Public Resources Code, Sections 5097.5, 5097.9	Would apply only if some Project land were acquired by the State of California	Section 8.15.2.2	Yes

8.15.2.2 State LORS

The California Energy Commission (CEC) environmental review process under the Warren-Alquist Act is considered functionally equivalent to that of the California Environmental Quality Act (CEQA) (Public Resources Code Sections 21000 *et seq.*). CEQA requires that public agencies and private interests identify the environmental consequences of their proposed projects on any object or site of significance to the scientific annals of California (Division I, California Public Resources Code: 5020.1 [b]). Guidelines for the Implementation of CEQA (Public Resources Code Sections 15000 *et seq.*) define procedures, types of activities, persons, and public agencies required to comply with CEQA. Appendix G, in Section 15023, provides an Environmental Checklist of questions that a lead agency should normally address if relevant to a project's environmental impacts. One of the questions to be answered in the Environmental Checklist (Section 15023, Appendix G, Section V, part c) is the following: "Would the project directly or indirectly destroy a unique paleontological resource or site?"

Although CEQA does not define what is "a unique paleontological resource or site," Section 21083.2 defines "unique archaeological resources" as "any archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1) [It] contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

2) It has a special and particular quality such as being the oldest of its type or the best available example of its type.

3) [It] is directly associated with a scientifically recognized import prehistoric or historic event."

With only slight modification, this definition is equally applicable to recognizing "a unique paleontological resource or site." Additional guidance is provided in CEQA Section 15064.5 (a)(3)(D), which indicates "generally, a resource shall be considered historically significant if it has yielded, or may be likely to yield, information important in prehistory or history."

Section XVII, part a, of the CEQA Environmental Checklist asks a second question equally applicable to paleontological resources: "Does the project have the potential to …eliminate important examples of the major periods of California history or pre-history?" To be in compliance with CEQA; environmental impact assessments, statements, and reports must answer both these questions in the Environmental Checklist. If the answer to either question is *yes* or *possibly*, a mitigation and monitoring plan must be designed and implemented to protect significant paleontological resources.

The CEQA lead agency having jurisdiction over a project is responsible to ensure that paleontological resources are protected in compliance with CEQA and other applicable statutes. The lead agency with the responsibility to ensure that fossils are protected during construction of the proposed MEGS is the California Energy Commission. California Public Resources Code Section 21081.6, entitled Mitigation Monitoring Compliance and Reporting, requires that the CEQA lead agency demonstrate project compliance with mitigation measures developed during the environmental impact review process.

Other state requirements for paleontological resource management are in California Public Resources Code Chapter 1.7, Section 5097.5 (Stats. 1965, c. 1136, p. 2792), entitled Archaeological, Paleontological, and Historical Sites. This statute defines any unauthorized disturbance or removal of a fossil site or remains on public land as a misdemeanor and specifies that state agencies may undertake surveys, excavations, or other operations as necessary on state lands to preserve or record paleontological resources. This statute would apply to the MEGS Project only if any construction or other related Project impacts occur on state-owned or managed lands or if the state or a state agency were to obtain ownership of any Project lands during the term of the Project license.

8.15.2.3 County and City LORS

Neither San Joaquin County (County) nor the City of Ripon (City) have regulations that specifically address potential adverse impacts to paleontological resources.

8.15.2.4 Professional Standards

The Society of Vertebrate Paleontology (SVP), an international scientific organization of professional vertebrate paleontologists, has established standard guidelines (SVP 1991, 1995, 1996) that outline acceptable professional practice in the conduct of paleontological resource assessments; surveys; monitoring; mitigation; data and fossil recovery; sampling procedures; and specimen preparation, identification, analysis, and curation. Most practicing professional paleontologists adhere closely to the SVP's assessment, mitigation, and monitoring requirements as specifically spelled out in these standard guidelines. Many federal and state regulatory agencies, including the CEC, have either formally or informally adopted the SVP standard guidelines.

8.15.3 Setting

8.15.3.1 Geographic Location

The site proposed for construction of MEGS is at the northwest corner of Stockton Avenue and Doak Boulevard in the city of Ripon, San Joaquin County, California. The Stanislaus River, which forms the southern boundary of San Joaquin County, is located one-half mile south of the MEGS site. The site is located at approximately 37º43'54" N. latitude and 121º07'29" W. longitude in the NE 1/4 NE 1/4 SE 1/4 of Section 30, T. 2 S., R. 8 E. The City of Ripon is located in the northeastern portion of the San Joaquin Valley, which comprises roughly the southern two-thirds of the major north-northwest oriented topographic and structural trough called either the Valle Grande (Clark, 1929), Great Valley (Fenneman, 1931), Great Central Valley (Piper, et al. 1939; Davis, et al. 1957), or Central Valley (Jahns, 1954). The Central Valley Physiographic Province is located between the Sierra Nevada Physiographic Province on the east and the Coast Ranges Physiographic Province on the west. The general Project area is bounded on the west by the floodplain of the San Joaquin River and on the east by the gently inclined alluvial fan of the Stanislaus River, which heads in the Sierra Nevada.

The proposed MEGS power plant site is adjoined by the future extension of South Stockton Avenue on the east and on the south by the future extension of Doak Boulevard. The MEGS site is currently a fallow, grass-covered field. Aerial photographs show that the site was an orchard in the recent past. The Project includes a 0.25-mile-long subtransmission line that

would connect with the MID electrical grid at MID's existing electrical substation, located on the east side of Stockton Avenue just east of the power plant site. In addition, the Project would include a 0.25-mile-long natural gas supply line, which would be located within Stockton Avenue and connect to an existing PG&E pipeline on West 4th Street. Both potable and non-potable water, wastewater discharge, and stormwater pipelines would be provided to the MEGS site through short (30-foot-long) lines connecting to tap lines being installed by the City of Ripon within South Stockton Avenue. These pipelines are part of a City infrastructure improvement project. A proposed 4.25-acre laydown area would be located immediately adjacent to the power plant site (see Figure 1-2). The proposed MEGS power plant site, electrical subtransmission line, natural gas supply line, water supply and discharge pipelines, and construction laydown areas would all be located within the boundaries of the City of Ripon. All these MEGS facilities are within the U.S. Geological Survey (USGS) Salida 7.5' Quadrangle (1:24,000-scale) standard topographic map.

8.15.3.2 Regional Geologic Setting

The general geology of the San Joaquin Valley has been described in some detail by Hoots, et al. (1954), Davis, et al. (1957, 1959), Davis and Hall (1959), Hall (1960), Hoffman (1964), Croft and Wahrhaftig (1965), Hackel (1966), Nicklen, et al. (1967), Marchand (1977), Marchand and Allwardt (1981), Page (1986), and Lettis (1988), among others. The information in these and other published reports form the basis of the following discussion. Individual publications are incorporated into this report and referenced where appropriate. For obtaining the older geological literature, the exhaustive compilation entitled *Geological Literature on the San Joaquin Valley of California*, by Maher, et al. (1973) was particularly helpful.

The geology in the vicinity of the proposed Project facilities has been geologically mapped by numerous workers, including Jenkins (1938, 1:500,000 scale), Davis and Hall (1959, 1:250,000 scale), Hall (1960, 1:62,500 scale), Rogers (1966, 1:250,000 scale), Marchand and Harden (1978), Bartow (1985, 1:250,000 scale), and Wahrhaftig, et al. (1993, 1:1,000,000 scale). The site-specific geology of the MEGS site and immediate vicinity will be considered separately below. The aspects of geology pertinent to this report are the types, distribution, and age of sediments immediately underlying the Project and their probability of producing fossils during Project construction.

The San Joaquin Valley is a great structural depression located between the tilted Sierra Nevada block on the east and the complexly folded and faulted Coast Ranges on the west. The Valley is filled with thick Mesozoic and Tertiary marine sediments covered by Quaternary alluvial sediments (Bailey, 1966). Along both sides of the San Joaquin Valley are a series of individual and coalescing alluvial fans, with their apices located where streams issue from the adjacent mountain ranges. These low relief alluvial fans form a discontinuous belt between the dissected uplands of the Sierra Nevada and the nearly flat surface of the valley bottom along the San Joaquin River. These alluvial fans are composed of undeformed to slightly deformed sediments deposited in Quaternary time by streams that drain the adjacent uplands. Each alluvial fan consists of a mass of coarse to fine rock debris that splays outward from the mouth of its stream channel onto the valley floor as a fan-like deposit of well-sorted sand and gravel encased in a matrix of finer sediments, chiefly poorly sorted fine sand and silt deposited away from the stream channels on the alluvial plain.

In the vicinity of the proposed MEGS, an alluvial fan has been created by rock debris deposited by the Stanislaus River, which drains off the foothills of the Sierra Nevada. Geological materials composing the alluvial fan in the vicinity of Ripon can be divided into three stratigraphic units, from oldest to youngest: weakly cemented conglomerate, sandstone, and siltstone referred to as the Middle Pleistocene Riverbank Formation exposed on the upper alluvial fan, a slightly younger and less consolidated Late Pleistocene sedimentary sequence named the Modesto Formation, and Holocene alluvium informally referred to as "River and Major Stream Channel Deposits" (Rogers, 1966) laid down immediately adjacent to the Stanislaus River and on the modern San Joaquin River floodplain. Each of these stratigraphic units has yielded fossil remains at previously recorded fossil localities within the Central Valley.

The Quaternary alluvial deposits that accumulated to form the Riverbank and Modesto alluvial fans consist of medium- to fine-grained sediment eroded primarily from Jurassic to Cretaceous granitic rocks in the adjacent Sierra Nevada. The alluvial fan deposits grade west- and southwest-ward through gradually decreasing grain sizes from coarse cobble to pebble gravel in the Sierra Nevada foothills to clay-rich silt on the San Joaquin River floodplain. The poorly sorted and lenticular gravel, sand, and silt that compose these alluvial fans have in the past produced abundant fossils, primarily of Pleistocene-age large land mammals such as mammoths, camels, bison, and horses. These paleontological resources will be discussed further below.

The limiting geologic ages of the three stratigraphic units composing the San Joaquin Valley alluvial fill are still uncertain. New excavations have the potential to yield important new information, new fossils, or other field evidence, which may add to, confirm, or require modifying previous age interpretations. This new information has the potential to also provide a more complete and accurate understanding of both the geological and biological history of the area.

8.15.3.3 Resource Inventory Methods

To develop a baseline paleontological resource inventory of the MEGS site and surrounding area and to assess the potential paleontological productivity of each stratigraphic unit present, the published as well as available unpublished geological and paleontological literature was searched and stratigraphic and paleontologic inventories were compiled, synthesized, and evaluated (see below). These tasks are in compliance with CEC (2000) and Society of Vertebrate Paleontology (1991; 1995) guidelines for assessing the importance of paleontological resources in areas of potential environmental impact. To obtain information for this assessment, no subsurface exploration was conducted. However, several local subsurface areas were examined during the field survey. Further paleontological assessment will be done in conjunction with pre-construction geotechnical surveys conducted to better define the subsurface geological features of the power plant site. These geotechnical borings could help determine the subsurface distribution of stratigraphic units and further evaluate their potential for producing scientifically important paleontological resources.

Stratigraphic Inventory

Geologic maps and reports covering the bedrock and surficial geology of the Project site and vicinity were reviewed to determine the exposed and subsurface stratigraphic units, to assess the potential paleontological productivity of each stratigraphic unit, and to delineate

their respective areal distribution in the Project area. In addition, available aerial photographs of the area were examined to aid in determining the areal distribution of distinctive sediment and soil types. During a survey of the area surrounding the proposed Project site conducted on January 16, 2003 by Dr. Lanny H. Fisk, Ph.D., R.G., a California registered geologist and senior paleontologist with PRC, it was discovered that the stratigraphy was visible along the banks of the Stanislaus Rivers and in several industrial wastewater ponds, sewage disposal ponds, and stormwater retention ponds, including unfilled ponds exposing up to 15 feet of stratigraphy located less than 0.25 mile from the MEGS site.

Paleontological Resource Inventory

Published and unpublished geological and paleontological literature (including previous environmental impact assessment documents and paleontological resource impact mitigation program final reports) were reviewed to document the number and locations of previously recorded fossil sites from rock units exposed in and near the Project site and the types of fossil remains each rock unit has produced. The literature review was supplemented by an archival search conducted at the University of California Museum of Paleontology (UCMP) in Berkeley, California, looking for additional information regarding the occurrence of fossil sites and remains in and near the Project site.

A field survey was conducted to identify and document exposed fossiliferous strata near the Project area and to determine the presence of any previously unrecorded fossil sites.

8.15.3.4 Resource Inventory Results

Stratigraphic Inventory

Regional geologic mapping of the proposed MEGS site and vicinity has been provided by Jenkins (1938; 1:500,000 scale), Davis and Hall (1959; 1:250,000 scale), Rogers (1966; 1:250,000 scale), Bartow (1985; 1:250,000 scale), and Wahrhaftig, et al. (1993; 1:1,000,000 scale). Larger scale mapping in the vicinity of the Project site has been provided by Hall (1960; 1:62,500 scale) and Marchand and Harden (1978; 1:24,000 scale). Unfortunately, in their geologic maps of the Late Cenozoic deposits of the area, geologists have not always used the formally named Riverbank and Modesto Formations of Davis and Hall (1959), nor have they consistently used the same map units. Both Davis and Hall (1959) and Hall (1960) mapped the area south of the Stanislaus River one-half mile south of the MEGS site as Pleistocene Modesto Formation. Rogers (1966) mapped the area in the vicinity of Ripon as "Recent alluvial fan deposits" but stated that these sediments were probably equivalent to the Late Pleistocene Modesto Formation of Davis and Hall (1959). In the floodplain of the Stanislaus River one-quarter mile south of the proposed MEGS site, Rogers (1966) mapped Quaternary alluvial sediments overlying the Modesto Formation as "Recent River and Major Stream Channel Deposits." Bartow (1985) simply mapped the entire Ripon area as Quaternary "Alluvial Deposits, Undivided," in which he included both the Riverbank and Modesto Formations and younger Quaternary alluvium. In the most detailed map of the Ripon area, Marchand and Harden (1978) mapped the Ripon and Salida 1:24,000-scale quadrangles up to within one-quarter mile south of the MEGS site. From their mapping, it takes little interpretation to see that the older river terrace upon which the MEGS is proposed to be built is equivalent to sediments mapped as Late Pleistocene Modesto Formation on terraces south of the Stanislaus River. Marchand and Harden (1978) mapped sediments in the floodplain of the Stanislaus River as "Late Holocene post-Modesto deposits." In the most

recent geologic map of the Ripon area, Wahrhaftig, et al. (1993) mapped the MEGS site and vicinity as Late Pleistocene "outwash sand and gravel," which they identified as the Modesto Formation. In summary, all these geologic maps are in agreement that the MEGS site is underlain by Late Pleistocene sediments of the Modesto Formation.

Piper, et al. (1939) published the first detailed descriptions of Quaternary sediments in the northeastern part of the San Joaquin Valley and named the Pleistocene strata the "Victor Formation." Davis and Hall (1959) subdivided sediments equivalent to the "Victor Formation" into the older Riverbank Formation and younger Modesto Formation. Marchand and Allwardt (1981) proposed that the older "Victor Formation" be abandoned and the Riverbank and Modesto Formations be accepted as uniform stratigraphic nomenclature for Quaternary deposits in the northeastern San Joaquin Valley; their recommendations have been followed by most later workers (see for instance Helley and Harwood, 1985) and are followed in this report.

The task of subdividing alluvial fan deposits is complicated by that fact that alluvial sediments are often lithologically similar. Davis and Hall (1959) addressed this problem by stating: "An important problem in attempting to differentiate geologic units in alluvial areas is that the sediments often are derived from a common source and are deposited in similar environments. All or nearly all of the alluvium of the east side of the San Joaquin Valley is derived from granitic and associated rocks of the Sierra Nevada that lie to the east. Thus, the formations offer no textural or lithologic bases for subdivision. Nevertheless, the use of the topographic expression of the units in conjunction with the development of their soils makes it possible to define formations." The three stratigraphic units (Modesto and Riverbank Formations and "River Channel Deposits") found in the area of Ripon are lithologically very similar (Davis, et al., 1957; Davis and Hall, 1959; Hall, 1960). This similarity is understandable since the sediments that compose each unit have been derived from the same source rocks in the headwaters of the Stanislaus River in the adjacent Sierra Nevada and were deposited in similar alluvial fan environments.

The primary differences recognized between the Modesto and Riverbank Formations are their age, degree of consolidation/cementation, amount of deformation (tilting and/or folding), and degree of soil development. The older Riverbank Formation has been uplifted and in some locations along the eastern margin of the San Joaquin Valley can be distinguished on that basis from the flat-lying younger Quaternary alluvium (Davis, et al., 1957; Davis and Hall, 1959; Hall, 1960). However, at many places along the eastern San Joaquin Valley, the dips increase westward so gradually that there is no apparent separation between the alluvium of the Modesto Formation and that of the Riverbank Formation. In these areas, separation of the younger Modesto Formation from the older Riverbank Formation is more difficult. Fortunately, at those places where Modesto alluvium overlies the Riverbank, the contact between the two units is frequently marked by a red clay paleosol (Davis and Hall, 1959; Hall, 1960).

Site Geology

As mapped by Davis and Hall (1959), Hall (1960), Rogers (1966), Marchand and Harden (1978), and Wahrhaftig, et al. (1993), the proposed MEGS site, the right-of-way (ROW) for the electrical subtransmission line, and the natural gas pipeline along Stockton Avenue are all located on Late Pleistocene alluvium of the Modesto Formation. At the MEGS site, the Modesto Formation is approximately 100 feet thick (Davis and Hall, 1959; Hall, 1960),

meaning that sediments of the Riverbank Formation would be highly unlikely to be impacted by Project construction, even from the deepest augering for the placement of concrete piles. The unnamed Quaternary alluvial sediments known as Holocene or Recent "River Channel Deposits" are not present at the proposed MEGS site, nor along the subtransmission line or natural gas pipeline ROWs, although they are present at the surface less than 0.25 mile south of the MEGS site, between the site and the Stanislaus River. Thus, MEGS construction will impact only sediments of the Modesto Formation.

The Pleistocene age Modesto Formation was first named by Davis and Hall (1959), who designated a type section along the south bluff of the Tuolumne River at the south edge of the City of Modesto. The Modesto Formation is composed of interbedded and poorly sorted, brownish sandstone and siltstone with lesser amounts of pebble to cobble conglomerate deposited primarily in a fluvial (stream) environment on low gradient alluvial fans. In places, Modesto sediments are fairly well cemented with either calcareous or hematite cements, but in other nearby locations they are only slightly cemented. These beds are believed to represent the Tioga glacial stage in the Sierra Nevada (Davis and Hall, 1959, Hall, 1960, Marchand and Allwardt, 1981).

Paleontological Resource Inventory

An inventory of the paleontologic resources of the Modesto Formation in or near the proposed Project site, including the electrical subtransmission line and natural gas pipeline, is presented below and the paleontological importance of these resources is assessed. The literature review and UCMP archival search conducted for this inventory documented no previously recorded fossil sites within the very limited footprint of the actual MEGS Project site, nor within the narrow linear corridors of the electrical subtransmission line and natural gas pipeline. However, a number of fossil sites were documented as occurring in sediments of the Modesto Formation near these facilities. In addition, fossil remains were found at a previously unrecorded fossil site during the field survey of the proposed Project site and vicinity conducted for this inventory.

An abundance of Pleistocene and Holocene vertebrate fossils have been reported from sediments referable to the Modesto Formation in the vicinity of the proposed MEGS power plant site. Surveys of Quaternary land mammal fossils have been made by Stirton (1939, 1951), Hay (1927), Savage (1951), Lundelius, et al. (1983), and Jefferson (1991b), and surveys of Quaternary birds, reptiles, and amphibians have been made by Miller and DeMay (1953) and Jefferson (1991a). Mammalian fossils from the Modesto Formation are Late Pleistocene or Rancholabrean in age. The mammals collected from this unit include mammoths, bison, horses, camels, ground sloths, and rodents (Jefferson, 1991b, UCMP records). The age of these Late Pleistocene Rancholabrean faunas is based on the presence of bison and on the presence of many mammalian species that are inhabitants of the same area today.

Modesto Formation

The Modesto Formation has yielded fossil remains at numerous sites in the San Joaquin Valley. These remains include petrified wood; shells of clams; and the bones and/or teeth of fish, amphibians, reptiles, birds, and a diversity of extinct land mammals, including moles, rodents, rabbits, ground sloths, mammoths, horses, camels, and bison (Davis, et al., 1957; Davis and Hall, 1959; Hall, 1960; Jefferson, 1991b; UCMP records). In addition to these previously reported occurrences, during a field survey of prospective fossiliferous sediments on January 16, 2003, Dr. Fisk discovered fossil burrow and root casts (ichnofossils) and plant

fragments in a paleosol (fossil soil) in the Modesto Formation, exposed in a stormwater retention pond on property owned by Fox River Paper Company, immediately adjacent to the east of the MEGS site. This locality is about 0.25 mile east-southeast of the proposed MEGS site. (See Confidential Figure 8.15-1, and Figures 8.15-2 and 8.15-3. Figures are located at the end of this section.)

A number of previously recorded fossil sites in the Modesto Formation are reported as having been uncovered by earth moving associated with previous construction projects (Reiche, 1950; Jefferson, 1991a and b; UCMP records). Jefferson (1991a and b) compiled a database of California Late Pleistocene (Rancholabrean North American Land Mammal Age) vertebrate fossils from published records, technical reports, unpublished manuscripts, information from colleagues, and inspection of museum paleontological collections at over 40 public and private institutions. He listed 9 individual sites in San Joaquin County and 14 in adjacent Stanislaus County that have yielded Rancholabrean vertebrate fossils.

Most, if not all, of these fossil sites would presumably be referable to the Modesto Formation. The UCMP has 15 separate fossil localities in Quaternary age sediments in San Joaquin County. Among the UCMP localities are 8 Rancholabrean vertebrate fossil localities discovered during construction of the Delta-Mendota Canal. Vertebrate fossils found during this construction project include extinct mammoths (both tusks and bones), mastodon (both tusks and bones), ground sloth, bison, tapir, camel, horse, and other large land mammals. All were collected from alluvial sediments considered to be Late Pleistocene (Reiche, 1950) and probably equivalent to the Modesto Formation. Numerous additional UCMP localities are located nearer the MEGS site, including UCMP locality V-87046 (“Lateral No. 6 Canal”) about 2.25 miles south-southeast at the junction of Covert Avenue and MID Lateral No. 6; V-72007 (“Hamett Road Locality”) about 3.25 miles south-southeast; V-72186 (“McManis Ranch Locality”) about 3.7 miles southeast; V-87045 (“Pelandale Road Locality”) about 4.5 miles southeast; V-81120 (“North Avenue Locality”) about 5.0 miles southeast; and V-81119 (“Woodland Avenue Locality”) about 6.0 miles southeast. Fossil remains of plants, clams, fish, birds, and mammals were also recently discovered 1.4 miles east of UCMP locality V-81119 during excavations for the MID Woodland Generation Station located on Woodland Avenue in the City of Modesto. Many of the fossil localities above were discovered from shallow excavations at a depth of 3 to 4 feet. Additional fossil localities have been reported from Pleistocene Rancholabrean sediments of the Modesto Formation during construction of the California Aqueduct, Hetch Hetchy Aqueduct, Wagner’s Aqueduct, Modesto Landfill, and various other construction projects in the greater Modesto-Salida-Ripon area. Similar discoveries to those made during excavations for these other construction projects could be made during excavations for the proposed MEGS Project, as it would be constructed in the same stratigraphic unit deposited during the same time period on the same alluvial fan.

In summary, sediments referable to the Modesto Formation have produced numerous fossils. Several previously recorded fossil localities are found near the proposed Project site, including a site containing fossil burrow and root casts (ichnofossils) and plant fragments in a paleosol 0.25 mile east-southeast of the MEGS site. Although no previously reported fossils are known to directly underlie the proposed MEGS power plant site or along the ROWs of the subtransmission line, natural gas pipeline or water supply and discharge lines, the presence of previously recorded fossil sites in sediments of the Modesto Formation

suggests that there is a high potential for additional similar fossil remains being uncovered by excavations during MEGS Project construction. Therefore, using SVP (1995) criteria, the Modesto Formation is judged to be highly sensitive to impacts from construction. Additional fossil remains discovered in sediments of the Modesto Formation during MEGS Project construction would be scientifically important and significant.

8.15.4 Impacts

The potential environmental impacts from construction and operation of the MEGS Project on paleontological resources are presented in the following subsections.

8.15.4.1 Environmental Checklist

The following table provides the CEQA Checklist questions that are used by the CEC to assess the significance of potential impacts.

	Potentially Significant Impact	Less than Significant w/Mitigation	Less than Significant	No Impact
PALEONTOLOGICAL RESOURCES—Would the project:				
a) Directly or indirectly destroy a unique paleontological resource or site or unique geological feature?		X		

8.15.4.2 Discussion of Impacts

Paleontological Resource Significance Criteria

In its standard guidelines for assessment and mitigation of adverse impacts to paleontological resources, the SVP (1995) established three categories of sensitivity for paleontological resources: high, low, and undetermined. The paleontological importance or sensitivity of a stratigraphic unit reflects: (1) its potential paleontological productivity (and thus sensitivity), and (2) the scientific significance of the fossils it has produced. Thus, the potential paleontological productivity of a stratigraphic unit exposed in a project area is based on the abundance of fossil specimens and/or previously recorded fossil sites in exposures of the unit in and near that project site. The underlying assumption of this assessment method is that exposures of a stratigraphic unit are most likely to yield fossil remains in quantity (and quality) similar to those previously recorded from that unit in and near the Project site.

An individual fossil specimen is considered scientifically important and significant if it is: (1) identifiable, (2) complete, (3) well-preserved, (4) age-diagnostic, (5) useful in paleoenvironmental reconstruction, (6) a type or topotypic specimen, (7) a member of a rare species, (8) a species that is part of a diverse assemblage, and/or (9) a skeletal element different from, or a specimen more complete than, those now available for that species (SVP, 1995). For example, identifiable land mammal fossils are considered scientifically important because of their potential use in providing very accurate age determinations and paleoenvironmental reconstructions for the sediments in which they occur. Moreover, vertebrate remains are comparatively rare in the fossil record. Although fossil plants are usually considered of lesser importance because they are less helpful in age determination,

they are actually more sensitive indicators of their environment and, thus, as sedentary organisms, more valuable than mobile mammals for paleoenvironmental reconstructions. For marine sediments, invertebrate fossils, including microfossils, are scientifically important for the same reasons that land mammal and/or land plant fossils are valuable in terrestrial deposits. The value or importance of different fossil groups varies depending on the age and depositional environment of the stratigraphic unit that contains the fossils.

The following tasks were completed to establish the paleontological importance and sensitivity of each stratigraphic unit exposed in or near the Project site:

- The potential paleontological productivity of each rock unit was assessed, based on the abundance of fossil remains and/or previously recorded and newly documented fossil sites it contains in and/or near the Project site.
- The scientific importance of fossil remains recorded from a stratigraphic unit exposed in the Project site was assessed.
- The paleontological importance of a rock unit was assessed, based on its documented and/or potential fossil content in the Project site and surrounding area.

This method of paleontological resource assessment is the most appropriate because discrete levels of paleontological importance can be delineated on a topographic or geologic map.

Stratigraphic units in which fossils have been previously found are deemed to have a high sensitivity and a high potential to produce additional fossils. In areas of high sensitivity, full-time monitoring by a professionally trained paleontologist is recommended during any Project ground disturbance. Stratigraphic units that are not sedimentary in origin or that have not been known to produce fossils in the past typically are deemed to have low or undetermined sensitivity and monitoring is usually not recommended nor needed during Project construction in these units. Stratigraphic units that have not had any previous paleontological resource surveys or fossil finds are deemed undetermined until surveys and mapping are done to determine their sensitivity. After reconnaissance surveys, observation of exposed strata, and possibly subsurface testing, a qualified paleontologist can determine whether the stratigraphic unit should be categorized as having high, low, or undetermined sensitivity; that is, whether there is a high, low, or undetermined potential to encounter fossil resources during construction. In keeping with the significance criteria of the SVP (1995), all vertebrate fossils are categorized as being of significant scientific value and all stratigraphic units in which vertebrate fossils have previously been found have high sensitivity. According to SVP (1995) standard guidelines, sensitivity comprises both: (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical; and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, or stratigraphic data.

Using the criteria of the SVP (1995) above, the significance of the potential adverse impacts of earth moving on the paleontological resources of each stratigraphic unit exposed in and near the Project site was assessed. This assessment reflects the paleontological importance/impact sensitivity of the stratigraphic unit, which, in turn, reflects the potential for fossil remains and fossil sites being encountered during earth moving. However, it should be noted that any impact on a fossil site or a fossil-bearing rock unit during

construction would be considered highly significant, regardless of the previously determined paleontologic importance of the rock unit in which the site or fossiliferous layer occurs. For example, grading in an area underlain by a rock unit with low sensitivity would have only a low potential to disturb fossil remains (i.e., the rock unit would have low sensitivity to adverse impacts). However, the loss of any fossil remains from that rock unit would be a highly significant impact.

8.15.4.3 Paleontological Resource Impact Assessment

The significance of potential adverse impacts of Project-related earth moving on the paleontological resources of the only stratigraphic unit exposed at the Project site or along the electrical subtransmission and natural gas pipeline ROWs is presented in this section.

Modesto Formation

The Modesto Formation has yielded significant plant, invertebrate, and vertebrate fossil remains at numerous previously recorded fossil sites, including one only 0.25 mile from the proposed MEGS site. Therefore, because of the high potential for the loss of similar scientifically important fossil remains during ground disturbance and earth moving for MEGS Project construction, the Modesto Formation is highly sensitive to adverse impacts on paleontological resources.

8.15.4.4 Summary of Paleontological Resource Inventory and Assessment

The potential adverse impacts on the paleontological resources resulting from construction of the MEGS Project is summarized in this section. Potential impacts on paleontological resources resulting from construction of the MEGS Project can be divided into construction-related impacts and plant-operation impacts. Construction-related impacts to paleontological resources primarily involve terrain modification (excavations and drainage diversion measures). No impacts on paleontological resources are expected to occur from the continuing operation of the MEGS Project or any of its related facilities.

Paleontological resources, including an undetermined number of fossil remains and unrecorded fossil sites; associated specimen data and corresponding geologic and geographic site data; and the fossil-bearing strata; could be adversely affected by (i.e., would be sensitive to) both direct and indirect environmental impacts resulting from ground disturbance and earth moving associated with MEGS Project construction. Direct impacts would result from grading of the power plant site; trenching for water lines and the natural gas supply pipeline; augering for concrete piling and the foundations for electrical towers or poles; and any other earth-moving activity that disturbed or buried previously undisturbed fossiliferous sediments, making those sediments and their paleontological resources unavailable for future scientific investigation. Although earth moving associated with construction of the Project site would be a comparatively short-term activity, the loss of fossil remains, unrecorded fossil sites, associated specimen data and corresponding geologic and geographic site data, and the fossil-bearing strata would be potentially long-term environmental impacts.

The proposed MEGS site is located on unconsolidated, Late Pleistocene alluvial deposits of the Modesto Formation overlying at depth Middle Pleistocene sediments of the Riverbank Formation. Because of its depth greater than about 100 feet below the surface, paleontological resources of the Riverbank Formation are not expected to be impacted by construction of the MEGS or any of its related facilities. Likewise, although Holocene

alluvial sediments mapped as "River Channel Deposits" are present at the surface less than 0.25 mile south of the MEGS site, between the site and the Stanislaus River, they are not expected to be impacted by MEGS construction. MEGS construction would impact only sediments of the Modesto Formation.

Site grading is not expected to result in significant adverse impacts to paleontological resources, as the ground surface in the area is relatively flat and has already been disturbed by previous farming and orchard activities. Neither are the support facilities, such as temporary construction offices, proposed laydown area(s), and parking areas, expected to have a significant adverse impact on paleontological resources, as they also would be located on ground previously disturbed and will involve no significant new ground disturbance. However, deeper excavations at the plant site for foundations for the new generators and excavations for the electrical subtransmission line poles and burial of the natural gas pipeline and water supply and discharge pipelines would potentially disturb fossiliferous sediments of the Modesto Formation, which contain Rancholabrean-age vertebrate fossils elsewhere. Consequently, Project-related ground-disturbing and earth-moving activities could potentially have adverse impacts on highly significant paleontological resources in the Modesto Formation.

8.15.5 Mitigation

8.15.5.1 Proposed Mitigation Measures

This section describes Applicant's proposed mitigation measures that would be implemented to reduce potential adverse impacts to significant paleontological resources resulting from Project construction. These proposed paleontologic resource impact mitigation measures would reduce to an insignificant level the direct, indirect, and cumulative adverse environmental impacts on paleontologic resources that might result from Project construction. The mitigation measures proposed below for the MEGS Project are in compliance with CEC environmental guidelines (CEC, 2000) and with SVP standard guidelines for mitigating adverse construction-related impacts on paleontologic resources (SVP, 1991; 1995; 1996).

Implementation of these mitigation measures would reduce the potentially significant adverse environmental impact of Project-related ground disturbance and earth moving on paleontological resources to an insignificant level by allowing for the recovery of fossil remains and associated specimen data and corresponding geologic and geographic site data that otherwise would be lost to earth moving and to unauthorized fossil collecting. With a well designed and implemented paleontological resource monitoring and mitigation plan, Project construction could actually result in beneficial impacts on paleontological resources through the possible discovery of fossil remains that would not have been exposed without Project construction and, therefore, would not have been available for study. The identification and analysis of fossil remains discovered as part of Project construction could help answer important questions regarding the geographic distribution, stratigraphic position, and age of fossiliferous sediments in the Ripon area.

Paleontological Monitoring

Prior to construction, a qualified paleontologist will be retained to both design and implement a monitoring and mitigation program during Project-related earth-moving activities for deep excavation at the power plant site, for deep boring for concrete piles (not

anticipated for this project) and electrical subtransmission towers, and for deep excavations for the natural gas pipeline and water supply and discharge pipelines. During construction, earth moving construction activities will be monitored where these activities will potentially disturb previously undisturbed sediment. Monitoring will not be conducted in areas where the ground has been previously disturbed or in areas where exposed sediment will be buried, but not otherwise disturbed.

Paleontological Monitoring and Mitigation Program

The paleontological resource monitoring and mitigation program will include: construction monitoring; emergency discovery procedures; sampling and data recovery, if needed; museum storage coordination for any specimen and data recovered; preconstruction coordination; and reporting.

Construction Personnel Education

Prior to start of construction, construction personnel involved with earth-moving activities will be informed that fossils may be encountered, on the appearance of fossils, and on proper notification procedures. This worker training will be prepared and presented by a qualified paleontologist.

8.15.5.2 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts on paleontological resources are anticipated as a result of the construction and operation of the MEGS and related facilities.

8.15.5.3 Cumulative Impacts

If paleontological resources were encountered during Project-related ground disturbance, the potential cumulative effect on paleontological resources would be low, as long as the mitigation measures proposed above in Section 8.15.5.2 were fully implemented to recover the resources. When properly implemented, these mitigation measures would effectively recover the value to science of significant fossils discovered during Project construction. Thus, the proposed Project would not cause or contribute to significant cumulative impacts to paleontological resources.

8.15.6 Involved Agencies and Agency Contacts

There are no State or local agencies having specific jurisdiction over paleontological resources.

8.15.7 Permits Required and Permit Schedule

No State or County agency requires a paleontological collecting permit to allow for the recovery of fossil remains discovered as a result of construction-related earth moving on state or private lands.

8.15.8 References

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Figure 8.15-1 is confidential

NOTE
SEDIMENTS OF THE LATE PLEISTOCENE MODESTO FORMATION EXPOSED IN A STORMWATER RETENTION POND ON PROPERTY OF THE FOX RIVER PAPER COMPANY APPROXIMATELY 0.25 MILE EAST-SOUTHEAST OF THE MEGS SITE. SHOVEL FOR SCALE IS 27 INCHES (68 CM) LONG.

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FIGURE 8.15-2
SEDIMENTS OBSERVED AT FOX RIVER PAPER COMPANY
MID ELECTRIC GENERATION STATION

CH2MHILL

NOTE
CLOSE-UP PHOTOGRAPH OF SEDIMENTS OF THE LATE PLEISTOCENE MODESTO FORMATION EXPOSED IN A STORMWATER RETENTION POND ON PROPERTY OF THE FOX RIVER PAPER COMPANY APPROXIMATELY 0.25 MILE EAST-SOUTHEAST OF THE MEGS SITE. NOTE THE DISCONTINUOUS BEDS OF FINE SAND AND SILT INTERBEDDED WITH CROSS-BEDDED MEDIUM TO COARSE SAND AND GRAVEL. SHOVEL FOR SCALE IS 27 INCHES (68 CM) LONG.

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FIGURE 8.15-3
SEDIMENTS OBSERVED
AT FOX RIVER PAPER COMPANY
MID ELECTRIC GENERATION STATION

CH2MHILL